WIDE-FIELD EXTENDED DEPTH DOUBLY TELECENTRIC CATADIOPTRIC OPTICAL SYSTEM FOR DIGITAL IMAGING

ABSTRACT OF THE DISCLOSURE

Focused imaging of constant size and resolution over a wide range of distances and a wide field of view in object space is provided by a doubly telecentric catadioptric optical system including an external limiting aperture at the juncture of the focal planes of two objectives, with a large-diameter concave spherical or aspheric mirror as the primary objective, and a camera lens as the secondary objective. Constant resolution avoids rescaling of images made at different depths for machine recognition tasks such as OCR, saving computation time and cost, and increasing through-put and accuracy. For digital linescan cameras, constant resolution of the image avoids scanning objects at different line rates for different depths of objects being scanned, thus maximizing speed of the objects and, hence, throughput. The field of view is constant over the entire range of depth and is not limited by the diameter of the camera lens elements. Undesirable cropping of the image of objects close to the imaging system is prevented. The effective f/number of the system is constant over the entire range of focus, and the image irradiance is more uniform over the entire field of view than with a traditional non-telecentric camera lens.